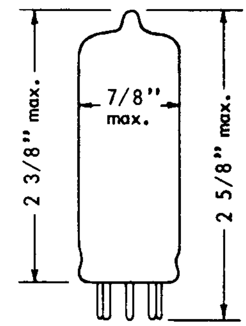
TYPE CK6414

Excellence in Electronics

The CK6414 is a heater-cathode type, medium-mu double triode of miniature construction. This type is characterized by long life and stable performance. The tube features a high zero-bias plate current, a sharp cutoff characteristic, and separate cathode connections for the two sections. It is especially designed for use in electronic computer applications and other "on—off" control applications requiring long periods of operation under cutoff conditions.



MECHANICAL DATA

ENVELOPE: T-6½ Glass

BASE: Miniature Button Base 9-Pin

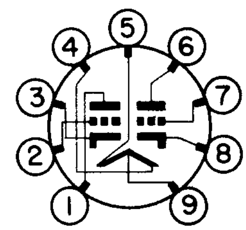
TERMINAL CONNECTIONS:

Pin 1 Plate, Unit #2
Pin 2 Grid, Unit #2
Pin 3 Cathode, Unit #2
Pin 4 Heater
Pin 5 Heater
Pin 6 Plate, Unit #1
Pin 7 Grid, Unit #1
Pin 8 Cathode, Unit #1
Pin 9 Heater Center Tap

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock Test-Note 3)	300 G
Maximum Vibrational Acceleration (96 Hour Fatigue Test-Note 4)	2.5 G
Maximum Bulb Temperature	100 °C

MOUNTING POSITION: Any



BOTTOM VIEW

9A

ELECTRICAL DATA

CAUTION-----To Electronic Equipment Design Engineers: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

RATINGS AND NORMAL OPERATION:	MIL-E-1 SYMBOL	DESIGN MINIMUM	NORMAL TEST CONDITIONS (Note 6)	NORMAL OPERATION (Note 5)	DESIGN MAXIMUM (Note 9)	MIL-E-1 UNITS
Heater Voltage (Note 10)	Ef: Series Ef: Parallel	12.0 6.0	 6.3	12.6 6.3	13.2 6.6	V V
Plate Voltage	Eb:	----	180	180	200	Vdc
Grid #1 Voltage	Ec1:	−50	−2.0	−2.0	+1.0	Vdc
Peak Positive Pulse Plate Voltage (Note 7):	eb:	----	----	----	500	v
Peak Grid Voltage (Note 8):	ec:	−100	----	----	+10	v
Plate Dissipation (Per Plate)	Pp/p:	----	----	1.45	2.0	W
Total Plate Dissipation, Both Plates:	Pp:	----	----	----	3.6	W
Grid Current (Per Grid)	IC/c:	----	----	----	1.0	mAdc
Peak Grid Current (Per Grid) (Note 8):	ic/c:	----	----	----	50	ma
Heater-Cathode Voltage (Note 11):	Ehk:	−100	----	----	+100	v
Cathode Current (Each Unit):	Ik/k:	----	----	8.0	17.0	mAdc
Peak Cathode Current (Each Unit) (Note 8):	ik/k:	----	----	----	160	ma
Transconductance (1) (Each Unit):	Sm (1):	----	----	5500	----	μmhos
Amplification Factor (Each Unit):	Mu:	----	----	42.5	----	

Tentative Data

ELECTRICAL DATA (cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)
(In the following tests, each unit is tested separately unless otherwise noted)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOGIE	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1			**Combined AQL = 1.0 % Excluding Mechanical, Inoperatives, and Short Test**							
Heater Cathode:		0.25	If:	425	435	450	465	475	36	mA
Heater-Cathode Leakage:	Ehk = + 100 Vdc	0.65	Ihk:	----	----	----	----	7	----	µAdc
	Ehk = −100 Vdc		Ihk:	----	----	----	----	7	----	µAdc
Grid Current:	Rg = 0.5 Meg.	0.25	Ic (1):	----	----	----	----	−0.3	----	µAdc
Plate Current (1):	Eb = 100 Vdc; G1 tied to plate through a 0.5 Meg. resistor	0.65	Ib (1):	13.6	15.5	17.0	18.5	20.4	4.8	mAdc
Plate Current (2):		0.65	Ib (2):	5.0	----	8.0	----	11.5	----	mAdc
Grid Voltage:	Eb = 150 Vdc; Ec 1/Ib = 150 µAdc	0.25	Ec 1:	----	----	−4.8	----	−7.5	----	Vdc
Grid Voltage Difference between Sections:	Eb = 150 Vdc; Ec 1/Ib = 150 µAdc	0.65	ΔEc 1:	----	----	----	----	1.5	----	Vdc
Continuity and Shorts (Inoperatives):		0.25	----	----	----	----	----	----	----	----
Shorts:	(Note 12)	----	----	----	----	----	----	----	----	----
Mechanical:	Envelope T−6½ (6-8)	----	----	----	----	----	----	----	----	----
MEASUREMENTS ACCEPTANCE TESTS PART 2			**(Combined AQL = 4.0%)**							
Transconductance (1):		2.5	Sm (1):	4000	5000	5550	6100	7250	1600	µmhos
Transconductance (2):	Ef = 5.7 V (Note 13)	2.5	Δ_{ef} Sm (2):	----	----	----	----	15	----	%
Contact Potential:	Eb = 0; Ec1/Ic = 0.1 µAdc; Rg = 0.1 Meg.	2.5	CP:	----	----	----	----	−1.5	----	Vdc
RF Noise:	Eb = 150 Vdc; Ec = 0; Ecal = 15 mVac; Rk = 220 ohms; ck = 0.2 µf; (Units connected in parallel)	2.5	EB:	----	----	----	----	5	----	VU
MEASUREMENTS ACCEPTANCE TEST PART 3			**(Combined AQL = 10% excluding capacitance and vibration (2)**							
Insulation of Electrodes:	Ef = 6.3 V; Eg-all = −100 Vdc	2.5	Rg-all:	1000	----	----	----	----	----	Meg.
	Ep-all = −300 Vdc		Rp-all:	1000	----	----	----	----	----	Meg.
Pulse Cathode Current:	Eb = 150 Vdc; Ec = −20 Vdc; ec = + 10 v; Prr = 1000 Pps; tp = 10 µsec.	2.5	ik:	160	----	----	----	----	----	ma
Amplification Factor:		2.5	Mu:	37	39.6	42.5	45.4	48	7.0	----
Grid Emission:	Ef = 6.7 V; Eb = 180 Vdc; Rg = 0.5 Meg.; Rk = 140 ohms Preheat 5 minutes at Ec1 = 0; Test at Ec1 = −30 Vdc	6.5	Isc 1:	0	----	----	----	−0.5	----	µAdc
Noise and Microphonics:	Ebb = 250 Vdc; Ecal = 100 mVac; Rp = 0.1 Meg.; Ec = 0; Rk = 1000 ohms; ck = 1000 µf; (units connected in parallel)	6.5	EB:	----	----	----	----	17	----	VU
Capacitance:			Cgp:	2.4	----	3.0	----	3.6	----	µµf
Capacitance:			C in:	3.0	----	4.0	----	5.0	----	µµf
Capacitance:			C out (Unit #1)	0.37	----	0.47	----	0.57	----	µµf
Capacitance:	(Note 2)	6.5	C out (Unit #2)	0.30	----	0.38	----	0.46	----	µµf
Capacitance:			Cpp:	----	----	----	----	0.90	----	µµf
Capacitance:			Cgg:	----	----	----	----	0.03	----	µµf
Capacitance:			Chk:	----	----	4.0	----	5.0	----	µµf
Vibration (2):	Rp = 2000 ohms; F = 25 cps; G = 2.5	6.5	Ep:	----	----	----	----	300	----	mVac

ELECTRICAL DATA (cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1) (cont'd)
(In the following tests, each unit is tested separately unless otherwise noted.)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per Characteristic 1st Sample	Combined Samples
DEGRADATION RATE ACCEPTANCE TESTS								
Shock:	Hammer Angle=20°; (Note 3)	20	----	----	----	----	----	----
Fatigue:	G=2.5 Fixed Frequency; F=25min., 60max., (Note 4)	6.5	----	----	----	----	----	----
Post Shock and Fatigue Test End Points:								
Vibration (2):	Rp=2000 ohms; F=25cps; G=2.5	----	Ep:	----	600	mVac	----	----
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	20	μAdc	----	----
	Ehk=−100 Vdc	----	Ihk:	----	20	μAdc	----	----
Plate Current (1):		----	Ib(1):	11.5	----	mAdc	----	----
Grid Current:		----	Ic(1):	0	−0.5	μAdc	----	----
Miniature Tube Base Strain:		----	----	----	----	----	----	----
Glass Strain (Thermal Shock):		2.5	----	----	----	----	----	----
ACCEPTANCE LIFE TESTS								
Heater Cycling Life Test:	Ef=7.5V; Ehk=+135 Vdc; Ec=Eb=0; 1 min. on, 1 min. off	1.0	----	2000	----	Cycles	----	----
Heater Cycling Life Test End Points:								
Heater-Cathode Leakage:	Ehk=+100 Vdc	----	Ihk:	----	15	μAdc	----	----
	Ehk=−100 Vdc	----	Ihk:	----	15	μAdc	----	----
100 Hour Stability Life Test:	TA=Room; Eb=100 Vdc; Rk=0; G1 tied to plate through a 0.5Meg. resistor (Note 14)	----	----	----	----	----	----	----
100 Hour Stability Life Test End Points:	(Typical Sample Size=50 tubes)	----	----	----	----	----	----	----
Plate Current (1):		2.5	Ib(1):	12.8	21.0	mAdc	----	----
Change in Plate Current (1) of individual tubes from initial:		2.5	Δ_tIb(1):	----	±1.7	mAdc	----	----
500 Hour Survival Rate Life Test:	(Sample consists of 20 tubes 1st sample 40 tubes second sample, of the 4 intermittent life tests) (Note 15)	----	----	----	----	----	2	5
1000 Hour Intermittent	T Bulb=120° C; Eb=180 Vdc; Ec=0; Rk=140; Rg=0.1Meg.; Ehk=+180 Vdc	----	----	----	----	----	----	----
1000 Hour Intermittent Life Test (1) End Points:	(Typical Sample Size=20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	----
Inoperatives:		----	----	----	----	----	1	2
Shorts:	(Notes 12, 16)	----	----	----	----	----	1	2
Grid Current:		----	Ic 1:	0	−0.5	μAdc	1	2
Plate Current (2):		----	Ib(2):	4.0	----	mAdc	1	2
Transconductance (1):		----	Sm(1):	3500	----	μmhos	1	2

ELECTRICAL DATA (cont'd)

CHARACTERISTICS AND QUALITY CONTROL TESTS (Note 1)

(In the following tests, each unit is tested separately unless otherwise noted)

TEST	CONDITIONS	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS	Allowable Defects per characteristic 1st Sample	Combined Samples
DEGRADATION RATE ACCEPTANCE TESTS								
Heater Current:		----	If:	425	495	mA	1	2
Heater-Cathode Leakage:	Ehk = +100 Vdc	----	Ink:	----	15	µAdc	1	2
	Ehk = −100 Vdc	----	Ihk:	----	15	µAdc		
Insulation of Electrodes: gl-all		----	Rg-all	100	----	Meg.	1	2
p-all		----	Rp-all	100	----	Meg.		
Contact Potential:		----	CP:	----	−1.5	Vdc	1	2
Total Defectives:		----	----	----	----	----	3	6
1000 Hour Intermittent Zero Bias Life Test (2):	T Bulb = 120°C Eb = 100 Vdc; Rk = 0; G1 tied to plate through a 0.5 Meg. resistor	----	----	----	----	----	----	----
1000 Hour Intermittent Zero Bias Life Test (2) End Points:	(Typical Sample Size = 20 tubes 1st sample, 40 tubes 2nd sample)							
Inoperatives:		----	----	----	----	----	1	2
Shorts:	(Notes 12, 16)	----	----	----	----	----	1	2
Grid Current:		----	Ic1:	0	−0.5	µAdc	1	2
Plate Current (1):		----	Ib(1):	11.5	21.0	mAdc	1	2
Total Defectives:		----	----	----	----	----	2	4
1000 Hour Intermittent Cutoff Life Test (3):	TA = Room; Eb = 180 Vdc; Ec = −50 Vdc; Rg = 0.1 Meg. (Typical Sample Size = 20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	----
1000 Hour Intermittent Cutoff Life Test (3) End Points:		----	----	----	----	----	----	----
Interface:	Ef = 6.0 Vdc; Eb = 125 Vdc; Ec1/Ib = 2.5 mAdc; Rk = 0. (Note 17)	----	Ri:	----	20	ohms	1	2
Inoperatives:		----	----	----	----	----	1	2
Shorts:	(Notes 12, 16)	----	----	----	----	----	1	2
Plate Current (1):		----	Ib(1):	11.5	21.5	mAdc	1	2
Pulse Cathode Current:		----	ik:	150	----	ma	1	2
Grid Emission:		----	Isc1:	0	−1.0	µAdc	1	2
Total Defectives:		----	----	----	----	----	2	4
1000 Hour Intermittent Pulse Life Test (4)	TA = Room; Eb = 180 Vdc; Rb = 200 ohms; Rg = 50 ohms; Ec = −20 Vdc; ec = +11.5 volts on driver side 4 Rg; tp = 10 ± 1µsec; duty cycle = 1%	----	----	----	----	----	----	----
1000 Hour Intermittent Pulse Life Test (4) End Points:	(Typical Sample Size = 20 tubes 1st sample, 40 tubes 2nd sample)	----	----	----	----	----	----	----
Inoperatives:		----	----	----	----	----	1	2
Shorts:	(Notes 12, 16)	----	----	----	----	----	1	2
Grid Current:		----	Ic:	0	−0.5	µAdc	1	2
Pulse Cathode Current:		----	ik:	150	----	ma	1	2
Total Defectives:		----	----	----	----	----	2	4

RAYTHEON

DOUBLE TRIODE

NOTES

Note 1: Characteristics, Quality Control Test Procedures, and Inspection Levels are made according to the appropriate paragraphs of MIL-E-1, "Inspection Instructions for Electron Tubes", and MIL-STD-105A.

Note 2: Without shield.

Note 3: Test conditions and acceptance criteria per Shock Test procedures of MIL-E-1 basic section.

Note 4: Test conditions and acceptance criteria per Fatigue Test procedures of MIL-E-1 basic section.

Note 5: These normal values represent conditions at which control of reliability may be separated.

Note 6: These normal test conditions are used for all characteristic tests unless otherwise stated under the individual test item.

Note 7: Rating based on a half-sinusoidal pulse of 10 milliseconds duration and 10 percent duty cycle.

Note 8: Rating based on a pulse of 10 microsecond duration, 1 percent duty cycle and 1000 pps repitition rate.

Note 9: Under no circumstances should the tube be operated beyond the following ratings: Ef = 13.2 V (6.6 V with parallel connections) max. and 12.0 V (6.0 V with parallel connections) min; Eb = 200 Vdc; Ik/k = 20 mAdc; ik/k = 200 ma; Pp/p = 2.2 watts, and Pp total for both sections = 4.0 watts.

Note 10: For most applications the performance will not be adversely affected by ± 10% heater voltage variation, but when the application can provide a closer control of heater voltage, an improvement in reliability will be realized.

Note 11: For pulse voltage of less than 1 percent duty cycle, the peak voltage may be 150 volts maximum.

Note 12: Special Short Test of 8 blows at 40 ± 10 G and of approximately 0.5 millisecond duration. Short rejection criteria shall be a permanent or intermittent short using and indicator with the following minimum sensitivity: 0.1 meg-15 μsec; 2.5 meg-1.0 ms. This test shall not be used to detect heater-cathode shorts.

Note 13: Change of transconductance for individual tubes from that value measured at Ef = 6.3 V to that value measured at Ef = 5.7 V.

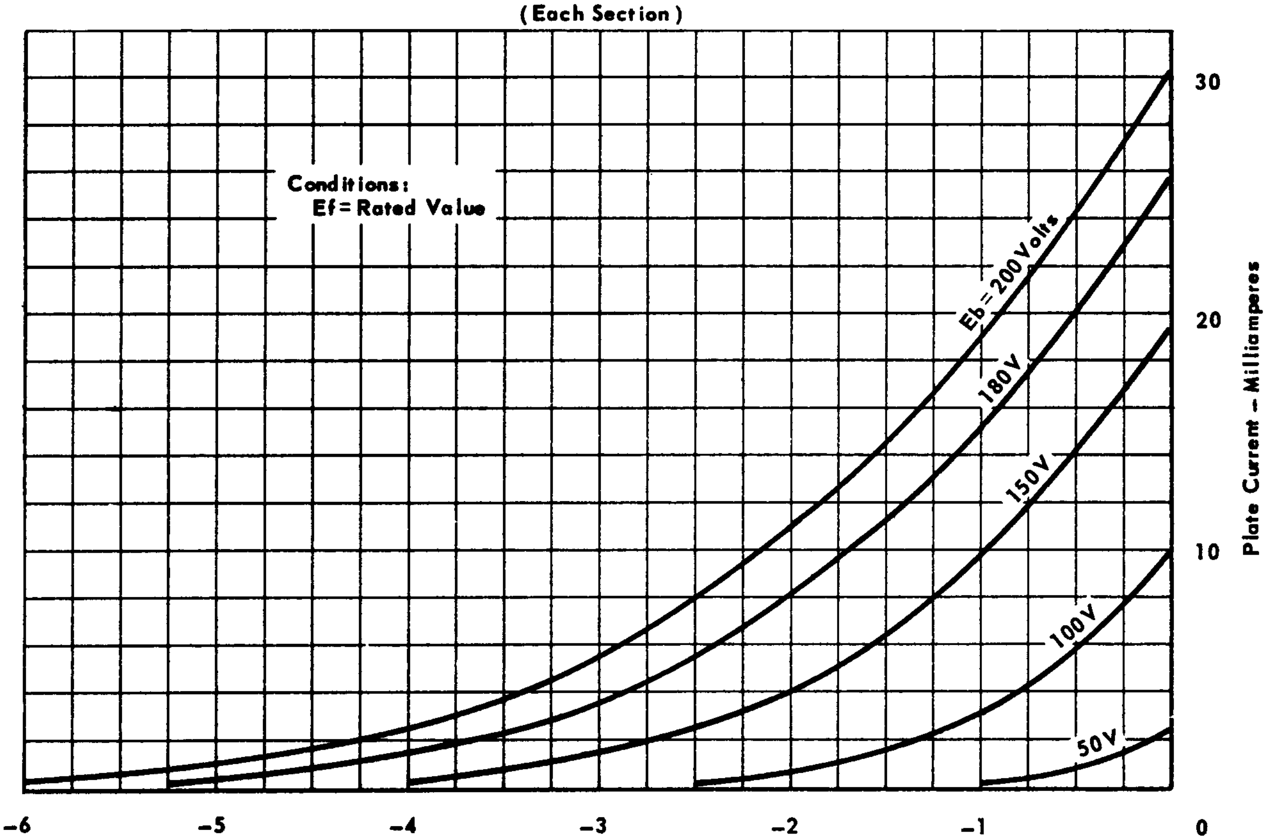
Note 14: Tubes to be read at 2, 48, and 100 hrs. for referenced characteristics.

Note 15: The Survival Rate Life Test sample shall consist of the same 80 tubes, (20 tubes on each Intermittent Life Test) which are subjected to the four Intermittent Life Tests. In the event of failure of the 1st sample for Survival Rate Life Test, a second sample of 160 shall be life tested for 500 hours (40 tubes on each Intermittent Life Test). Acceptance shall be based on the total number of inoperatives. The acceptance number shall be two for the first sample of 80 tubes and five for the combined first and second samples (240° tubes).

Note 16: Shorts to be tested at 0 and 1000 hrs. only and shall be the last test performed on sample.

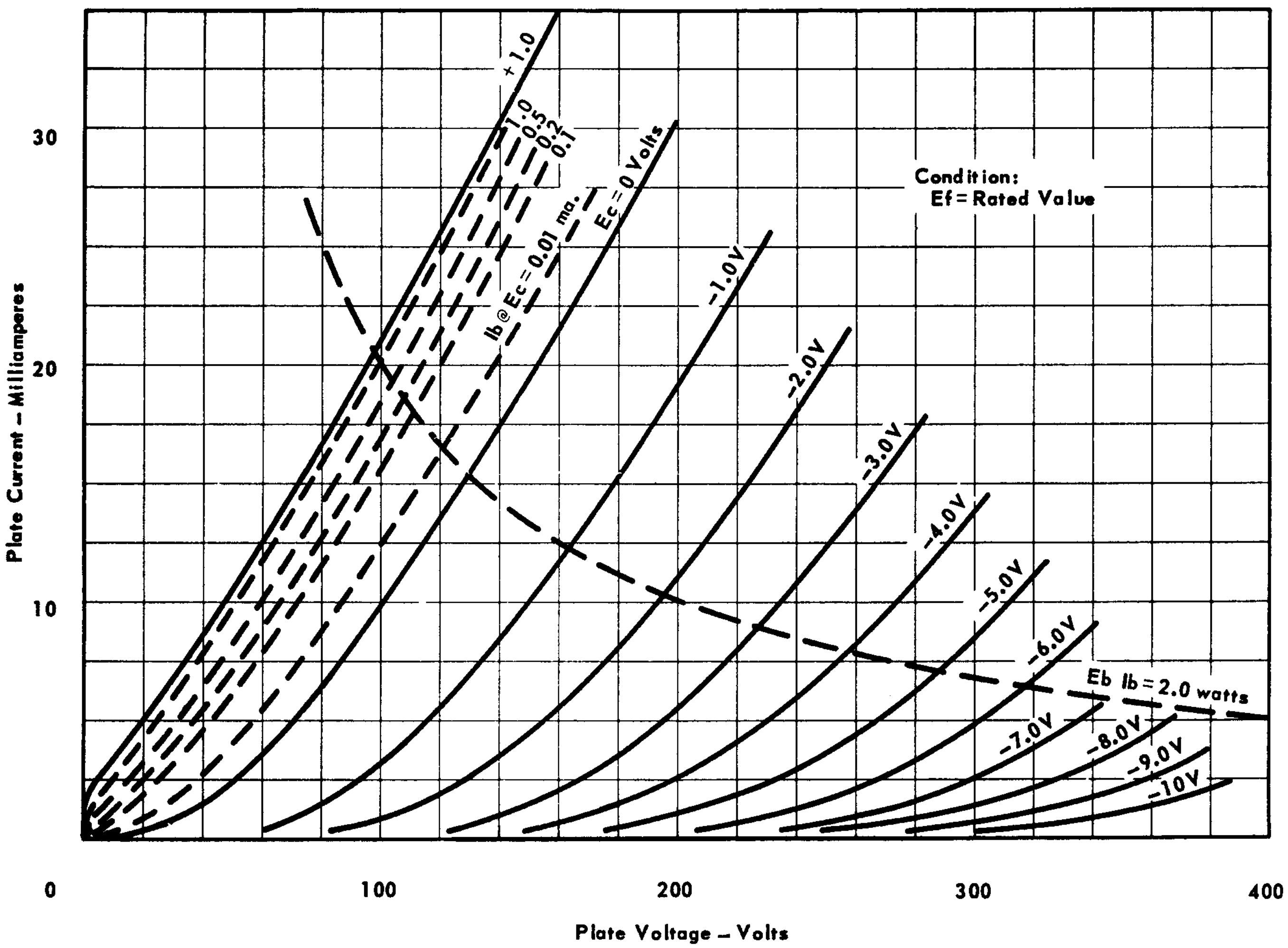
Note 17: Interface shall be measured before any other tests. Tubes shall be preheated (heaters in parallel) for five minutes with Ef = 6.0 V and all other elements disconnected.

AVERAGE TRANSFER CHARACTERISTICS
(Each Section)



DOUBLE TRIODE

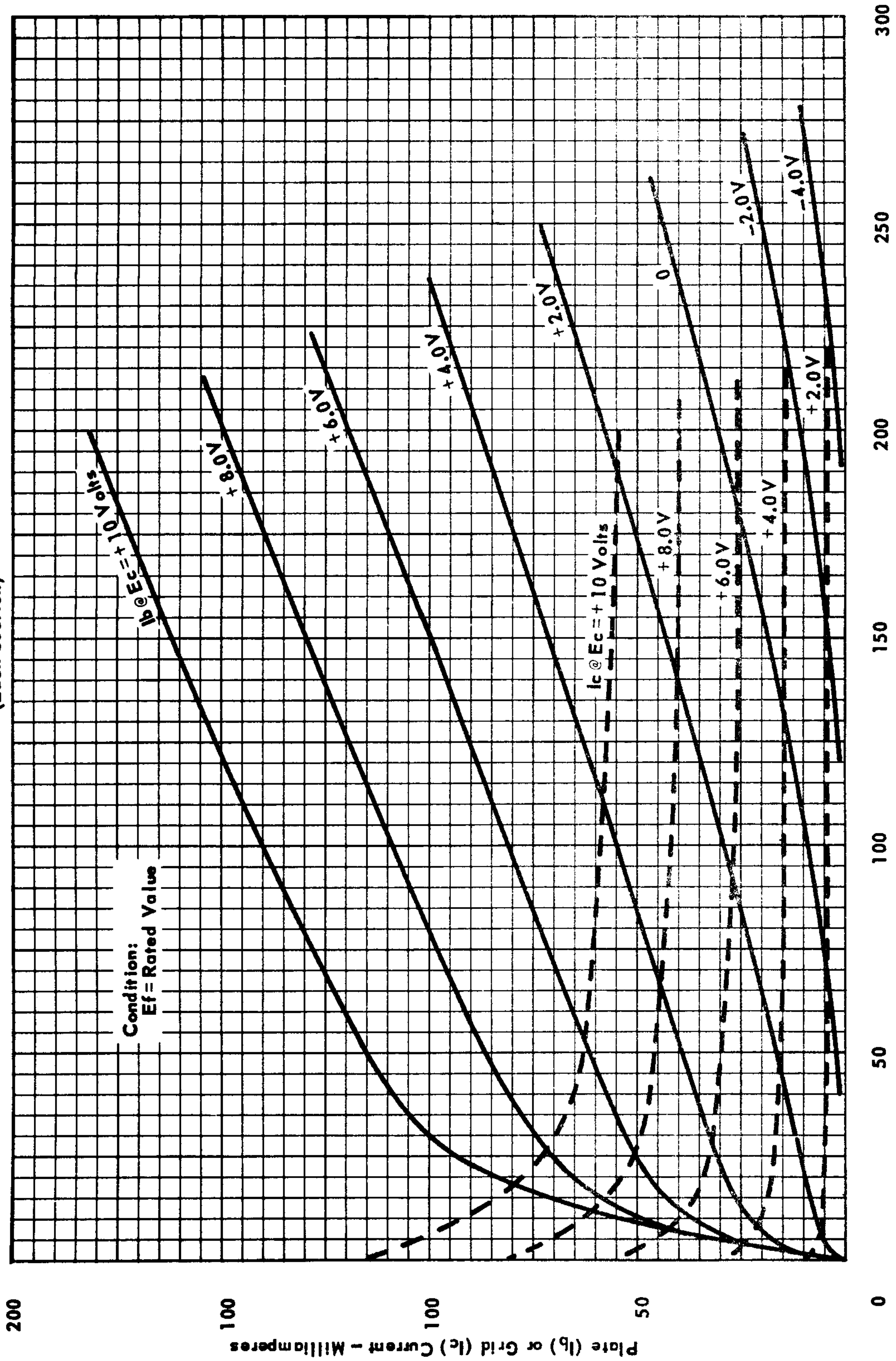
AVERAGE PLATE CHARACTERISTICS
(Each Section)



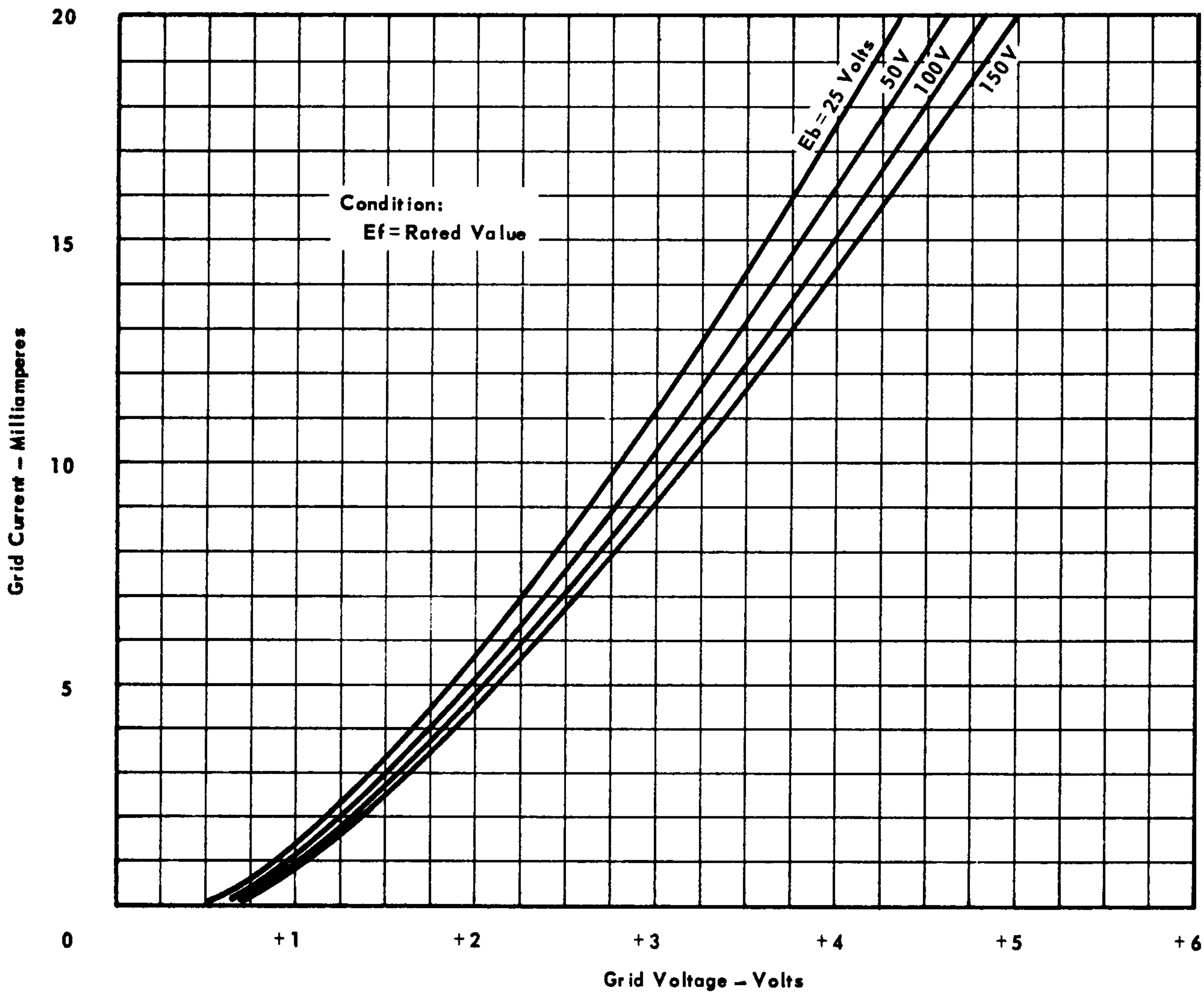
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AVERAGE PLATE CHARACTERISTICS
(Each Section)

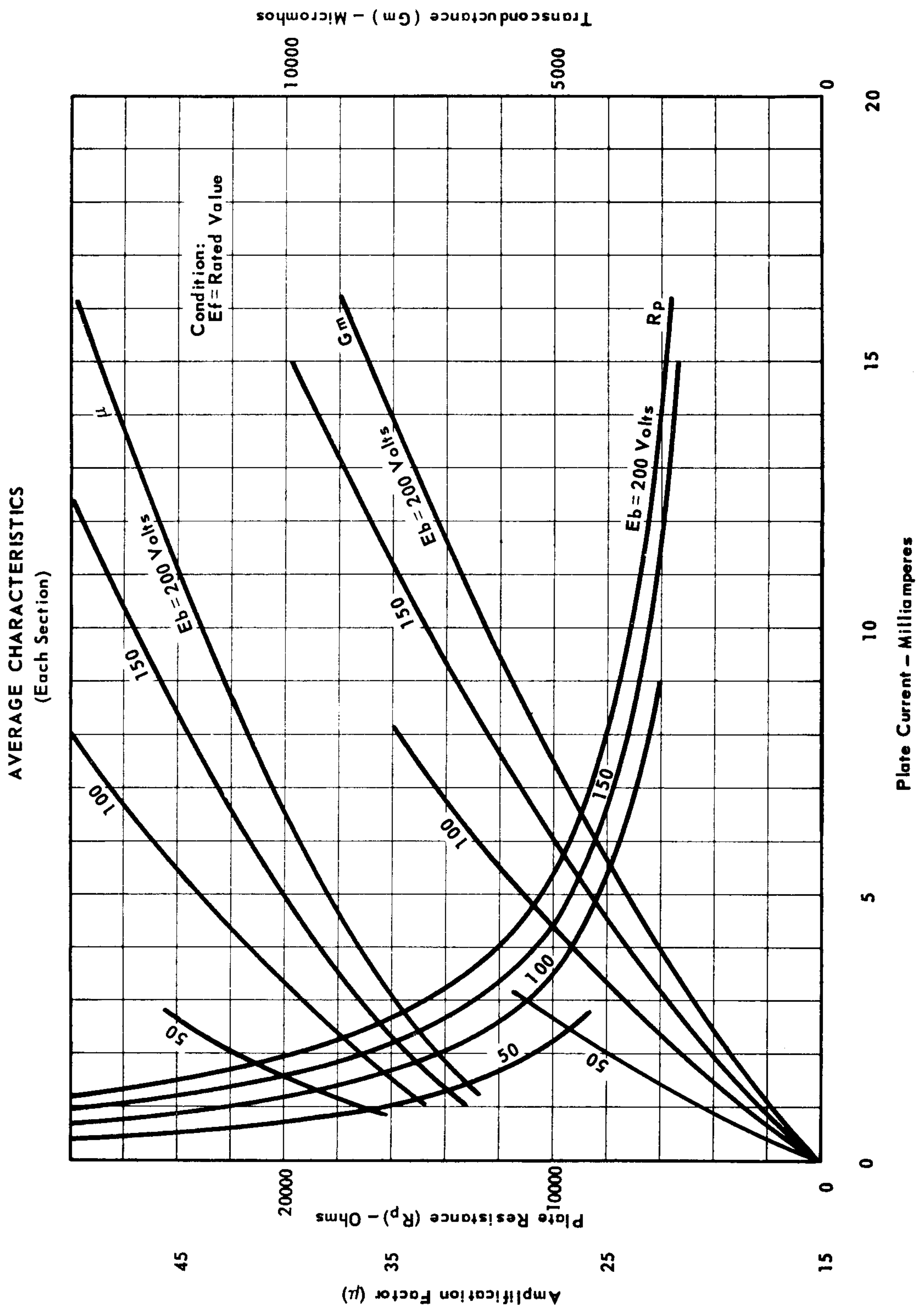


AVERAGE CHARACTERISTICS
(Each Section)



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DOUBLE TRIODE



RAYTHEON MANUFACTURING COMPANY

RECEIVING TUBE AND SEMICONDUCTOR OPERATIONS